



ACC. NO.

DATE



NOTICE

OF

SIR WILLIAM EDMOND LOGAN.

FROM

THE REPORT OF THE COUNCIL OF THE AMERICAN ACADEMY
OF ARTS AND SCIENCES, MAY, 1876.

CAMBRIDGE:

PRESS OF JOHN WILSON AND SON.
1876.

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SIR WILLIAM EDMOND LOGAN.

SIR WILLIAM EDMOND LOGAN, Knight, was born in Montreal, Canada, in 1798, and died at Castle Malgwyn, Llechryd, in South Wales, June 22, 1875. Like so many others who have attained distinction in British North America, Logan was descended from a loyalist stock, one of those families who, adhering to the British crown, left the revolted colonies a hundred years since. His grandfather then removed from the neighborhood of Schenectady, N.Y., to Montreal, carrying with him two sons, one of whom was the father of our late associate. They were of Scottish origin; and when the father and uncle of Mr. Logan had gained wealth in commercial pursuits, and transferred their business as merchants and bankers to Great Britain, the former purchased a small estate near Stirling in Scotland, a circumstance which has led one of his English biographers into the error of speaking of Mr. Logan as a Scotchman. His education, begun in Montreal, was continued at the High School and the University of Edinburgh; but we find him already at the age of twenty in the counting-house of his uncle in London, where he remained for ten years, devoting much of his leisure to the study of natural history, as well as to music and painting, in both of which he was a successful amateur. In 1829, his uncle having acquired an interest in a copper-smelting establishment, with some coal lands, at Swansea in South Wales, Logan removed there to assume their direction, where he remained for nine years, becoming a successful copper-smelter and coal-miner. The study of the coal-field of the neighborhood here engaged his attention, and he made of it a very careful and minute map, which was presented by him to the British Association in 1837. When, later, the geological survey of Great Britain under De la Beche was extended to this region, the work of Logan was placed at the disposal of the government, and, its exactness having been verified, was adopted and pub-

lished by the survey. In the course of these labors, he made careful studies as to the relations of the stigmaria constantly found in the clays which immediately underlie the coal-beds, and in 1840 brought this matter before the Geological Society of London, announcing the conclusion that the stigmaria belonged to the plants which had furnished at least a large part of the coal. It was afterwards shown that other observers had already indicated a similar relation, and that Mammatt, from his studies of the coal-field of Ashby-de-la-Zouche, had in 1836 maintained that the coal was the product of a vegetation *in situ*, rooted in the under-clay. To Logan is, however, due the credit of careful and original observations on the subject, which he subsequently extended to the coal-fields of Nova Scotia and Pennsylvania, which were visited by him in 1841. In 1842, he was offered the direction of a geological survey of Canada, which he accepted, beginning his work in the spring of 1843, with the aid of Mr. Alexander Murray, now director of the geological survey of Newfoundland. It was not till four years later that he was joined by Dr. T. Sterry Hunt. The labors of Logan for 1843 and 1844 were directed to the coal basin of Nova Scotia and New Brunswick and to the paleozoic formations of the adjacent peninsula of Gaspé, and included his study of the now famous section of the Joggins at the head of the Bay of Fundy, where over 14,000 feet of coal measures, including seventy-six coal seams, are displayed in unbroken sequence. In 1845, his attention was turned to the more ancient rocks which appear on the Ottawa River and its tributaries; and in 1846 he made with Mr. Murray a preliminary survey of the geology of the north shore of Lake Superior.

It is with the ancient crystalline rocks that his name will be chiefly associated, and especially with the formations since called Laurentian and Huronian; and it may be well in this connection to state briefly the results of their examination by the Canadian survey, which now belong to the history of geological science. The gneissic character of the crystalline rocks which were known to underlie the paleozoic formations in northern New York and Canada had long been recognized; but the prevalent view with regard to such gneissic rocks, both there and elsewhere, was that expressed by Emmons, who had carefully studied them in the first-named region, that they were igneous or fire-formed rocks, the laminated structure of which is not due to the intervention of water. He maintained that they were in no sense of sedimentary origin, and included no sedimentary layers, a view to which some recent writers still incline. In the first year of the

Canadian (1844), he declared that the Adirondack to be regarded as a term which meant the same as in 1847, they were apparently of limestones upon these report a new underlying prior in 184 indicated an upper one epidote, as and conglomerate series being

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Canadian survey, however, Mr. Murray (in his report published in 1844), having studied these rocks to the north of Lake Ontario, declared that these granites and gneisses (the extension of those of the Adirondacks) "present evidences of stratification," and were therefore to be regarded not as primary, but rather as "metamorphic" rocks; a term which had been proposed by Lyell to designate crystalline sedimentary strata. In the subsequent report of Logan, who examined the same rocks on the Ottawa in 1845, and published his report in 1847, they were again described as "metamorphic rocks, . . . apparently of sedimentary origin, chiefly syenitic gneiss with crystalline limestones," which were said to be distinctly interbedded. Resting upon these on Lake Temiscaming, Logan described in the same report a newer series, chiefly of chloritic slates, holding pebbles of the underlying gneiss; and in his report of his examination of Lake Superior in 1845 (also published in 1847), these two series were distinctly indicated as a lower formation of granitic gneiss, often syenitic, and an upper one of micaceous, chloritic, and talcose slates, frequently with epidote, associated with hornblende rocks and greenstones, quartzites, and conglomerates including pebbles of the older rocks; this upper series being probably several thousand feet in thickness.

In their report for 1851 on the geology of Lake Superior, Messrs. Foster and Whitney also described these crystalline rocks, including the two divisions, as the Azoic system, which they recognized as of sedimentary origin. The farther studies of the Canadian survey established the importance of the two divisions, and the necessity of separate designations for them; and in Logan's report for 1853 (published in 1854) the name of the Laurentian series was given to the lower formation, which forms the chief part of the elevated region to the north-west of the St. Lawrence to which the title of the Laurentide Mountains had been previously assigned. The name of Laurentian has since been adopted for the similar rocks of Continental Europe and of the British Isles. In 1855, the designation of Huronian was given by the Canadian survey to the upper division, including the series characterized by greenstones and talcose and chloritic schists, which is largely developed on the shores of Lakes Huron and Superior (where it had been carefully studied and mapped by Mr. Alexander Murray), and constitutes the Huron Mountains to the south of the latter lake.

The subsequent labors of Logan on the Ottawa established clearly the regularly stratified character of the Laurentian series, of which he measured about 20,000 feet, consisting of four gneiss formations separated by three limestones, each of the latter having a thickness of

from 1,000 to 1,500 feet, and associated with quartzites; the whole constituting a series comparable in value to the entire lower Paleozoic. These strata, greatly affected by undulations and penetrated by eruptive rocks, were by Logan traced with infinite labor over an area of 2,000 square miles; and a geological map of this region, published by him in the *Atlas to the Geology of Canada* in 1863, is the first attempt to unravel the stratigraphy of this most ancient and disturbed series of rocks.

At the summit of this series was found a mass of about 10,000 feet of stratified crystalline rocks, which, unlike those below, consisted chiefly of labradorite and hypersthene rocks, with some little included gneiss and quartzite and a band of crystalline limestone. This series Logan subsequently showed to be unconformable to the older gneisses, and gave it the name of Upper Laurentian, subsequently exchanged for that of Labradorian or Norian.

Indirect evidence that these lowest rocks were not really Azoic was soon pointed out, and in 1858 obscure forms resembling those of *Stromatopora* were detected in the Laurentian limestones, and were exhibited by Logan to the American Association for the Advancement of Science, in 1859, as probably organic; but it was not till 1864 that Dawson announced that these and other similar forms were the remains of a gigantic rhizopod, to which he gave the name of *Eozoön Canadense*. The history of this curious form is well known, and its organic nature, though at one time much contested, is now disputed by few.

To Logan we owe a large part in the investigations of the Canadian Survey which have established the following great facts in the geology of the Azoic or, as they may henceforth be called, the Eozoic rocks:—

I. The relations of the Laurentian as a great stratified series of crystalline rocks of aqueous origin, occupying a position at the base of the known geological column and containing evidences of organic life.

II. The fact of the unconformable superposition to the Laurentian of the Upper Laurentian or Norian series.

III. The first recognition that unconformably overlying the Laurentian was still another series of crystalline stratified rocks, the Huronian. (The relative ages of the Norian and Huronian still remain undetermined, for the reason that they have never yet certainly been found in juxtaposition.)

IV. The fact that the Laurentian, Norian, and Huronian, are all of them unconformably overlaid by the lower members of the New York Paleozoic series.

His labors on the Laurentian rocks were continued at intervals up to 1867, and were performed with an amount of fatigue and sacrifice

of personal comfort which can only be understood by those who have had to traverse those rugged forest regions. He often wandered for days through a wilderness, with a prismatic compass in hand, counting his paces, and gathering rock-specimens as he went. His notes, made in pencil, were always written out each night in ink, and the journeyings of the day protracted, often by the light of the camp-fire.

In the intervals of these investigations, Logan was devoting his attention to another region of crystalline rocks, the extension of the Green Mountains of Vermont through northern Canada to a point a little south-east of Quebec, the study of which he began in 1847. The previous attempts to establish a parallelism between the geological succession in eastern New York and western New England had led most American geologists to suppose that the crystalline schists of the latter region were the stratigraphical equivalents of the lower members of the New York Paleozoic series in an altered condition; though there were not wanting those who, with Emmons, regarded these crystalline strata as a part of the primary or so-called Azoic series. Logan, who began, as was his custom, to work out the stratigraphy of these rocks in minute detail, accepted the views of the majority on this disputed question, and endeavored to establish a parallelism between the subdivisions of these crystalline strata of the Green Mountains and their prolongation into Canada, and the uncrystalline fossiliferous strata which are found everywhere along their north-western base from the valley of Lake Champlain. These, the so-called Upper Taconic of Emmons, he at first looked upon as newer than the Trenton limestone, but, yielding to the evidence of organic remains, assigned them at length to their true position immediately below the horizon of this limestone, and named them the Quebec group. These uncrystalline strata were really newer rocks than the crystalline lines (of which they include fragments), Logan was unwilling to admit, and spent many years in an unsuccessful attempt to establish a correspondence between the two series. That these latter rocks, called by him the "altered Quebec group," belong to the same Huronian series which he was the first to distinguish farther to the westward as of pre-paleozoic age, will now be questioned by none who have compared the two regions.

The record of Logan's later life is little else than that of his patient and unwearying devotion to the work of the geological survey of Canada, of which he remained the director for twenty-five years. In 1863, he prepared and published, with the aid of Professor James Hall, a geological map of north-eastern America, including the region north to

James's Bay, south to Virginia, and west to Nebraska. This map, on a scale of twenty-five miles to the inch, remains the most complete attempt to delineate the geology of the region. His other published works are confined to the reports of the geological survey, and a few papers to scientific societies on kindred subjects. He had little aptitude for literary labor, and found the work of composition difficult. He rendered good service to science and to his native country at the international exhibitions of 1851 and 1855, being a juror at the first, and a commissioner at the second. On the latter occasion he was knighted by the Queen, and by the Emperor Napoleon made a chevalier of the Legion of Honor, in which order he was subsequently raised to the rank of officer. He was a Fellow of the Royal Society of London, of the Imperial Leopoldo-Carolinian Academy of Germany, and of many other scientific societies. In the year 1857, he was president of the American Association for the Advancement of Science.

In 1869, his advancing years and failing health, together with the necessity of devoting more time to his large estate, led him to resign his position as director of the geological survey, though he still continued to spend a portion of his summer in geological exploration, much of which was in the western parts of Vermont and Massachusetts. The incompleted results of these last few years, however, remain unpublished. He left his home in Montreal in August, 1874, to spend the autumn and winter in Great Britain, intending to return to his geological labors in the spring; but, his bodily ailments increasing, he died and was buried at the home of his sister in Wales.

Sir William Logan was unmarried, and, though genial and kindly in his social relations, led a solitary and very retired life. His work in science was neither that of a paleontologist, a lithologist, or a mineralogist; in all of which departments he was, throughout his career, ably seconded by the labors of James Hall, Sterry Hunt, Dawson, and Billings. His great merit was the possession of a rare skill in stratigraphy, and an amount of patience, industry, and devotion to his work, which has rarely been equalled, and has enabled him to connect his name imperishably with the geology of the older rocks.

T. S. H.